SEEDS

Workshop Paper #1:

Strawman Requirements / Levels of Service

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Questions for the Workshop:

1. One objective for the requirements / levels of service is to cover all significant areas of cost. Based on your experience, is there an area of cost or cost factor that is not addressed, or not addressed specifically enough, in the requirements / levels of service?

2. Another objective has been to keep the number of requirements to a minimum and to avoid over-detailed requirements. From a functional point of view, are there areas of functionality that are not addressed or not addressed specifically enough?

3. A third objective has been to develop practically meaningful and distinct levels of service for most requirements. Are there additional or better levels of service for any of the requirements that you would recommend?

Outline

1 Introduction

This draft SEEDS (Strategic Evolution of Earth Science Data Systems) general requirements and levels of service paper, an update of the original November 30, 2001 version, is an extract from Version 5 of the "SEEDS Requirements / LOS & Cost Model Working Paper - New Years' Draft", January 16, 2002. Readers are encouraged to refer to the Version 5 Working Paper for a the full context of the requirements / levels of service, e.g. their relationship to the general data center reference model and its functions and parameters, and to the development of requirements / levels of service for ESE data center types as subsets of the general requirements / levels of service.

The draft requirements / levels of service will be presented as a strawman to the community at the February 5-7, 2002, SEEDS Community Workshop, and will be updated per the results of the workshop.

The ultimate objective of this study is to provide the SEEDS Formulation Team with a capability to estimate the cost for various system architectures (arrays of cooperating data service providers) and mission profiles. Successful development of a life cycle cost estimation capability will be dependent on an accurate assessment of the levels of services needed from ESE data service providers. "Levels of service" are associated with certain functional requirements, describing different degrees of performance with which the requirement would be met. For example, a functional requirement might be: "The data service provider shall distribute data and products to users on media". Accompanying this requirement might be descriptions of quantitatively distinct levels of service, such as "delivery on media shall be provided within one working day of receipt of a data request", "delivery on media shall be provided within two calendar weeks of receipt of a data request", and "delivery on media shall be provided within one calendar month of receipt of a data request". Which level of service would be most appropriate ('recommended') or acceptable ('minimum') for a particular ESE data service provider would depend on its particular mission and the needs of its users.

1.1 Requirements and Cost Modeling

The requirements developed by this study are intended to support the cost model, and not to serve as the complete definition of the requirements side of a contract between the SEEDS program office and ESE data service providers, or as a basis for procurements. These requirements will be 'end-to-end' in that they will encompass all significant elements of cost, and will be directly and explicitly traceable to cost.

1.2 Data Service Providers, the Reference Model, and Requirements

The term 'data service provider' is used herein as a broad, generic term for a site that performs all or a subset of the functions defined in the general data service provider reference model (see below). Many well known actual data centers such as the Distributed Active Archive Centers or the NOAA data centers will perform a subset of the general list of functions, while some sites described as 'data service providers' for this study, e.g. MODAPS (as a sample of a science team processing facility that does not perform archive or general user distribution), are different in function from many well known data centers but fit within the framework of the data service provider reference model.

The general data service provider reference model will map to a general requirements template, a statement of requirements / levels of service for a generic data service provider, in which the requirements / levels of service are defined for all of the functional areas included in the model.

The general data service provider reference model will have subsets corresponding to the tentatively defined ESE data service provider types. (This approach has the advantage of allowing the future definition of additional data service provider types, or variations of the types defined herein, i.e. other possible subsets, within the same general framework.) Likewise, the general set of requirements / levels of service will have subsets corresponding to each of the data service provider types.

The requirements / levels of service are a template in that they contain placeholders for quantitative parameters that will be defined for a specific instance of a data service provider of a particular type. For example, a requirement in the template might be that "the data service provider shall provide an archive capacity of [number TB]". A data service provider of a type that would include providing an archive would have that item in its template. If the mission of the data service provider required that it archive certain data streams and generated products that would accumulate to a total volume of 100 TB, then that value would be inserted into the template, with the result being a specific requirement for that data service provider (i.e., "the data service provider shall provide an archive capacity of 100 TB") that could then be used in the process of generating a cost estimate for the data service provider.

The data service provider reference model, essentially an array of functions vs parameters (metrics) that apply to the functions, is the core concept. The requirements and levels of service are mapped to the functions as templates with placeholders for quantitative values; the placeholders are replaced with actual values when the template is applied to a particular data service provider case. The 'comparables' database contains, for each of a number of real data service providers or activities, sets of real values for the same parameters for those functions performed by each data service provider.

2 General Data Service Provider Reference Model - Functional Areas

This section describes the Data Service Provider Reference Model, a model of a data service provider in terms of a set of functional areas that, taken together, comprise the range of functions that a data center performs and the areas of cost that must be considered by the cost estimation model. This extract from Section 4 of the full working paper describes the reference model's functional areas.

The first step is the outlining of a simple reference model of a generic ESE data service provider in terms of a set of functional areas that taken together comprise the full range of functions that a data service provider might perform and implementation and operating costs it would incur. The different types of data service providers would function within all or some of these areas. In each functional area, the cost estimation model will consider implementation and operations costs. Some of the areas are not strictly speaking "functional" in nature (such as 'facility / infrastructure') but are needed to ensure that all significant cost areas are included. The list of functional areas can be taken in toto as a summary of the areas of cost included in the model.

The following are working definitions of the functional areas that make up the data service provider reference model:

- **Ingest**—the process of receiving, reading, quality checking, cataloging, of incoming data to the point of insertion into the archive. Ingest can be manual or electronic with manual steps involved in quality checking, etc. Incoming data can be received from external sources or internally generated. Ingest can include format conversion, metadata extraction, or other preparation of incoming data for archive or use within the data service provider.
- **Processing**—the generation and quality checking of new derived data products from data or products that have been ingested, or previously generated, generally on a routine, operational basis. Processing includes process control (production planning, scheduling, monitoring, etc.) as well as product generation per se. The data service provider may receive the software that embodies product generation algorithms from outside developers (e.g. some Terra instrument teams for the DAACs currently) who are responsible for the initial delivery and for delivering updated versions. Where quality, especially science quality, of products remains the responsibility of an outside developer, processing includes quality checking by the science software developer. Support provided by the data service provider for integration and test of this 'science software' is included as an activity under processing. In cases where a data service provider develops algorithm software, that effort (i.e. development, integration, and test) is included under Development.
- **Documentation**---the development (or upgrading of received) data and product documentation to meet adopted standards, including catalog information (metadata), user guides, etc., through consultation with

data providers, algorithm developers, flight projects, etc.

- **Archive**—the insertion of data into archive storage, and management, handling and preservation of data, metadata, and documentation within a data service provider's archive. Inserted data can include data ingested from sources external to the site, or data/products generated on-site. Handling and preservation include quality screening of data entering and exiting the archive, quality screening of archive media, backups, and accomplishing migrations from one type of media to another. Insertion into the archive can be electronic or manual (e.g. hanging tapes on a rack or popping them into a robotic silo).
- **Distribution**—providing access to catalog information and a search and order capability to users, receiving user requests for data, fetching the requested data from the archive, performing any subsetting, reformatting / format conversion, or packaging, and providing the end product to the user by electronic means or on physical media. Catalog search and order can include providing local user interface and capability and/or providing an interface to a broader based, cross-site search and order capability (e.g. DAACs supporting search and order via the EOS Data Gateway).
- **User Support**—user support provided in direct contact with users by user support staff, including responding to queries, taking of orders, etc.
- **Instrument / Mission Operations** - monitoring instrument and spacecraft performance, generating instrument and spacecraft commands, and event scheduling (using NASA or other appropriate operational mission management services).
- **Sustaining Engineering** - Maintenance and enhancement of custom applications software (including any science software embodying processing algorithms developed by the site).
- **Engineering Support** - Some or all of the following as applicable at a particular site: systems engineering, test engineering, configuration management, coordination of hardware maintenance by vendors, COTS procurement, installation of COTS upgrades, system administration, database administration, network/communications engineering. Engineering support is internal, directed toward the internal operation of the data service provider.
- **Technical Coordination** - Includes participation in SEEDS system level processes, including coordination on standards and interfaces, work on common metrics, overall architecture, etc. Technical coordination, which by its nature includes engineering, is directed outward, supporting the data service provider as one element of a system of cooperating centers.
- **Implementation---**Includes development of, and making operational, the data and information system capabilities required by the data service provider to perform its mission, including design and implementation of the data system (hardware and system software) and applications software. Implementation can recur during the operating period as systems are expanded or replaced. In some cases applications software will include product generation software embodying science algorithms. Development can include development of software tools for use by users to unpack, subset, or otherwise manipulate products provided by the data service provider.
- **Management** - Includes management and administration at the data service provider level ("front office") and direct management of functional areas, and internal support: some or all of the following as applicable at a particular site: logistics, supplies, facilities, security management, property inventory and management, facility management.
- **Facility / Infrastructure** - Includes a variety of non-staff cost factors such as supplies, facility lease and utility costs and other similar overhead costs, hardware maintenance, COTS licenses, etc.

3 Strawman Requirements / Levels of Service

This section (a complete extract of Section 5 from the full working paper) presents the first step in the results of the requirements / levels of service analysis, which is development of a requirements / levels of service template for a generic ESE data service provider that is consistent with and linked to the general data service

provider reference model described in above. The linkage between the requirements template and the reference model will be the reference model parameters that must be specified to accomplish cost estimation.

The term 'template' is used for two reasons. The first is that all of the requirements / levels of service will not apply to all types of ESE data service provider. The second reason is that the requirements contain placeholders for specifics that must be filled in (i.e. choices between alternatives shown, or between possible levels of service, or replacement of placeholders with lists or numerical values) to generate from the template a set of requirements / levels of service that apply to a specific ESE data service provider, and that allow a cost estimate for it to be produced.

Not all requirements have levels of service associated with them; by their nature, some requirements are either met or not met without any shades of gray. For example, item 3.7 b below states: "The data service provider shall provide for secure, permanent storage of data at the "raw" sensor level (NASA Level 0 plus appended calibration and geolocation information)." There is no fuzz on this requirement, it will apply in full force, or not apply at all, depending upon whether or not the data service provider is responsible for that specific form of data.

Section 3.1 contains a draft set of high level or programmatic requirements referred to as "NewDISS Level 0 Requirements" produced by the SEEDS Formulation Team in September, 2001. These provide an umbrella for the more specific requirements that follow, and downward traceability will be indicated, and, for now, the term 'NewDISS' is retained in this section as this is a reproduction of the original document.

Sections 3.2 through 3.9 present the general requirements / levels of service template that corresponds to the general data service provider reference model. As such it does not imply or embody any architecture, i.e. any allocation of requirements to various particular components. The requirements are organized into categories as site-wide (those that apply to a general ESE data service provider as a whole), and by functional area. Where appropriate, individual requirements are associated with levels of service. Placeholders for items to be specified when the template is to be used to generate requirements for a specific data service provider are enclosed in brackets […]. Upward traceability back to the draft program level requirements will be indicated.

Guidance for the initial set of requirements and levels of service was drawn from the ESDIS Project Level 2 Requirements for EOSDIS Version 0, updated March 2000, which addressed requirements and levels of service, the report "Global Change Science Requirements for Long-Term Archiving", NOAA-NASA and USGCRP Program Office, March 1999, and the report "Ensuring the Climate Record from the NPP and NPOESS Meteorological Satellites", NRC Committee on Earth Studies, September 2000.

3.1 Draft Program Level Requirements

This section contains the set of program level requirements drafted by the SEEDS Formulation Team in September, 2001, as "NewDISS Level 0 Requirements", with the new term "SEEDS" replacing "NewDISS". The cost model requirements template that follows fits within the general framework of the program level requirements in this section.

3.1.1 General Requirements

a. Data service providers will fully participate (TBD) in SEEDS community-based management processes including standards and interface determination, reuse/architecture refinement, metrics collection, and Enterprise peer review.

b. All data service providers will comply with SEEDS Level of Service requirements for core functions and data products (TBD) and will adhere to SEEDS required core interfaces and standards (TBD). Deviation from core standards must be requested and approved via the SEEDS waiver process (TBD).

c. Data service providers will provide metrics (TBD) on data production and utilization to the SEEDS Office on a routine (TBD) basis.

d. Data service providers and projects will participate in an annual (TBD) broad-based peer review of ESE data management activities.

e. ESE Mission Projects will produce a Life Cycle Data Management (LCDM) Plan. Changes to the LCDM plan will be approved by the SEEDS Office (TBR).

f. To the extent possible and where cost effective, data service providers will reuse software and system components developed by previously NASA funded activities. Projects will enable possible reuse of their software available by following the system design guidelines provide by the SEEDS reference architecture (TBD).

3.1.2 General Science Requirements

g. Data service providers will provide support to and receive technical direction from an appropriate NASA ESE science parameter team.

h. Principal Investigators will propose a suite of standard science products subject to peer review approval of an Algorithm Theoretical Basis Document.

i. Each data service provider will have a Science Advisory Group that will review progress and plans on a routine basis.

3.1.3 Production, Archive, and Distribution Requirements

a. All raw data will be acquired will be calibrated and geolocated to a reference sphere. Calibrated and georeferenced data will made available to all users.

b. Data at the "raw" sensor level (NASA Level 0 plus appended calibration and geolocation information) must be archived permanently.

c. All standard science data (Level 1b, Level 2, and Level 3) produced will be made available to any user who requests it without discrimination.

d. All standard data products available to a science team member will be made available to general science users.

e. All standard data produced will be archived until the end of the science mission or until transfer to an approved permanent archive.

f. Data service providers will receive orders for data products from the general public and will fulfill those orders with an average delivery time (elapsed time between when the order was completed and product was shipped) of less than five working days.

3.1.4 Standards and Interface Compliance

a. Metadata for all standard products will be produced in accordance with the SEEDS core metadata standard.

b. Metadata for all archived standard data products must be searchable by spatial and temporal extent, and must be locatable by the general user via the world wide web.

c. Standard data products made available to the LTA, to another SEEDS data service provider and to users will be available in one of the SEEDS core formats.

d. All standard data products will be cataloged in the Global Change Master Directory (GCMD). Data service providers will provide Directory Interchange Format (DIF) documents on all standard data products to the GCMD prior to release of the data products.

3.2 Site-Wide Requirements / Levels of Service

These requirements apply to the reference data service provider as a whole.

3.2.1 Management

a. The data service provider shall provide management and administrative staff to perform supervisory, financial administration, and other administrative functions.

b. The data service provider shall provide staff required for participation in SEEDS management processes, architecture refinement, metrics collection, annual Enterprise peer review, development and maintenance of a life cycle data management plan, and support for its Science Advisory Group.

c. The data service provider shall provide staff required for participation in SEEDS processes for developing and maintaining common standards and interface definitions.

3.2.2 Internal Support

a. The data service provider shall maintain system security and data integrity while providing easy access to its data and information services for its user community.

b. The data service provider shall provide and maintain a fully furnished and equipped, environmentally controlled, physically secure facility to house its staff, systems, and data and information holdings.

c. The data service provider shall provide a backup facility for its data and information holdings.

   Levels of Service:

   1) an environmentally controlled and physically secure off-site backup archive facility;

   2) an on-site but separate environmentally controlled and physically secure off-site backup facility;

   3) a backup capability within the data service provider's primary data system(s).

d. The data service provider shall perform resource planning, logistics, supplies inventory and acquisition, and facility management.

3.2.3 Engineering Support

a. The data service provider shall perform system administration, network administration, database administration, coordination of hardware maintenance by vendors, and other technical functions as required for performance of its mission.

   Levels of Service:

   1) no or very infrequent interruptions of data service provider operations;

   2) occasional interruptions in data service provider operations;

   3) as needed, with interruptions in data service provider operations a secondary concern.

b. The data service provider shall perform systems engineering, test engineering, configuration management, COTS procurement, installation of COTS upgrades, network/communications engineering and other engineering functions as required for performance of its mission.

   Levels of Service:

   1) no or very infrequent interruptions of data service provider operations;

   2) occasional interruptions in data service provider operations;

   3) as needed, with interruptions in data service provider operations a secondary concern.

3.3 Instrument and Mission Monitoring and Command Requirements

a. The data service provider shall monitor the status and performance of [name] instruments and in some cases also [name] spacecraft for which it is responsible, generating instrument commands and in some cases spacecraft commands as needed.

b. The data service provider shall obtain the services of a NASA (or other spacecraft operator as appropriate) mission operations facility to provide instrument and spacecraft data and to receive, validate, and transmit instrument and/or spacecraft commands to the spacecraft.

3.4 Ingest Requirements / Levels of Service

a. The data service provider shall ingest the following data [ingest data stream table, listing for each data stream: name, source, product types ingested, products ingested per day of each type, volume ingested per day]. The input data streams should cover all data to be received by the center, e.g. satellite data streams, ancillary data products, processed products generated by other data service providers, etc., based on its ESE mission.

   Levels of Service:

   1) operational (time-critical) ingest with immediate verification of data integrity and quality;

   2) routine ingest and verification of data quality and integrity without tight time constraints;

   3) ad hoc or intermittent ingest on a non-operational basis with verification of data quality and integrity;

   4) ad hoc or intermittent ingest on a non-operational basis.

   Levels of service can be mixed within a data service provider; i.e. different levels may be appropriate for different data streams.

3.5 Processing Requirements / Levels of Service

a. The data service provider shall generate the following standard products, included required Level 1B products [standard product table, listing for each product type/series: name, product instances produced per day, volume per day, required input data streams] on a highly reliable, operational basis, either on a routine schedule or on-demand, based on its ESE mission.

   Levels of Service:

   1) standard products shall be generated within 2 days of ingest/availability of required inputs;

   2) standard products shall be generated within 7 days of ingest/availability of required inputs;

   3) standard products shall be generated within 30 days of ingest/availability of required inputs.

b. The data service provider shall generate the following products [product table, listing for each product type/series: name, average product instances produced per day, average volume per day, required input data streams] on an ad hoc, non-operational basis.

   Levels of Service:

   1) specific targets for processing adopted on a case by case basis;

   2) general goals for processing;

   3) no goals, purely ad hoc processing.

c. The data service provider shall reprocess standard products [standard product table] on an ad hoc basis in response to reprocessing requests.

   Levels of Service:

   1) the capacity for reprocessing shall be 9 times the original processing rate;

   2) the capacity for reprocessing shall be 6 times the original processing rate;

   3) the capacity for reprocessing shall be 3 times the original processing rate.

d. The data service provider shall provide standard metrics on production to the SEEDS Office.

3.6 Documentation Requirements / Levels of Service

a. The data service provider shall generate and provide standard compliant catalog information (metadata, including browse) and documentation describing all data and information held by the data service provider.

   Levels of Service:

   1) data and product holdings documented to the standard for long term archiving;

   2) documentation ensured to be sufficient for current use;

   3) documentation only as received from product provider.

b. The data service provider shall update documentation of data and products with user comments.

   Levels of Service:

   1) data and products routinely updated with user comments;

   2) data and products occasionally updated with user comments;

   3) data and products rarely updated with user products.

c. The data service provider shall generate and provide DIF (directory interchange format) documents to the Global Change Master Directory on all products available from the data service provider prior to their release for distribution.

3.7 Archive Requirements / Levels of Service

a. The data service provider shall add to its archive or working storage the following data and products [archive product table, drawn from ingest data stream table, standard product, and ad hoc product tables and reprocessing volume] and related documentation / metadata.

b. The data service provider shall provide for secure, permanent storage of data at the "raw" sensor level (NASA Level 0 plus appended calibration and geolocation information).

c. The data service provider shall provide for secure storage of all standard or other science products it produces until the end of the science mission or until transfer to an approved permanent archive, per its data management plan.

d. The data service provider shall provide for an [archive] [working storage] capacity of [number] TB.

   Levels of Service:

   1) archive capacity is cumulative sum of all data ingested plus all products generated;

   2) archive capacity is limited to a specified threshold.

e. The data service provider shall perform quality screening on data entering the archive (e.g. read after write check when data is written to archive media) and exiting the archive (e.g. track read failures and corrected errors or other indication of media degradation on all reads from archive media).

   Levels of service:

   1) exit and entry screening;

   2) entry screening.

f. The data service provider shall take steps to ensure the preservation of data in its archive.

   Levels of service:

   1) 10% per year random screening;

   2) 5% per year random screening;

   3) 1% per year random screening.

g. The data service provider shall provide a backup for its [archive] [working storage].
Levels of service:

1) full off-site backup, with regular sampling to verify integrity;

2) partial, [Backup Fraction - % of archive backed up], off-site backup, with sampling;

3) partial, [Backup Fraction - % of archive backed up], on-site backup with sampling.

h. The data service provider shall use robust archive media.
Levels of Service:

1) archive media compliant with NARA standards;

2) archive media consistent with commercial practice.

i. The data service provider shall plan and perform periodic migration of archive to new archive media / technology.
Levels of Service:

1) planned migration;

2) no planned migration, but ad hoc migration as need is seen to arise.

(Note - this requirement would not apply to a data service provider with a shorter lifetime than a migration cycle appropriate for its archive media / technology.)

3.8 Distribution Requirements / Levels of Service

a. The data service provider shall provide users with access to all metadata and data and information holdings, including all standard science products (Level 1b, Level 2, and Level 3) produced by the data service provider.
Levels of Service:

1) public access to all users;

2) access to the science community;

3) access to a limited team of scientists.

b. The data service provider shall provide data and products to users in (at a minimum) one of the SEEDS core formats.

c. The data service provider shall enhance its distribution capability with supporting services such as subsetting, reformatting, and packaging as needed for performance of its mission.
Levels of Service:

1) supporting services available for most archived data and products;

2) supporting services available for less than half of archived data and products;

3) supporting services available for a few selected data and products only.

d. The data service provider shall provide a world wide web accessible search and order capability to [all users (including the general public) consistent with SEEDS standards and practices; to a limited set of science team members]. (Accessibility consistent with the level of service for requirement 5.8 a above.)
Levels of Service:

1) allow search for instances of product types by geophysical parameter, time, and space across multiple product types;

2) allow search for instances of multiple product types by time and space;

3) allow search for instances of single product type by time and space.

e. The data service provider shall provide data to users on an [operational, subscription, and/or in response to request] basis.

f. The data service provider shall perform timely distribution of data and products to users by network, providing an average distribution volume capacity of [number] TB per day.

   Levels of service:

   1) availability of a product for network delivery within ten seconds;

   2) availability of a product for network delivery within ten minutes;

   3) availability of a product for network delivery within twenty four hours.

g. The data service provider shall perform timely distribution of data and products to users on SEEDS standard media types in response to user requests, providing an average volume capacity of [number] TB per day.

   Levels of Service:

   1) shipping of media product within three days of receipt of request;

   2) shipping of media product within one week of receipt of request,

   3) shipping of media product within one month of receipt of request.

h. The data service provider shall have the capacity to distribute products on an average of [number] media units per day.

i. The data service provider with final ESE archive responsibility (i.e., a Backbone Data Center unless, for example, a Science Data Service Provider held its products to the time for their transfer to the long term archive) shall transfer its data, products, and documentation (done to the long term archive standard) to the designated long term archive according to its Life Cycle Data Management Plan.

j. The data service provider shall provide SEEDS standard metrics on distribution to the SEEDS Office.

3.9 User Support Requirements / Levels of Service

a. The data service provider shall be capable of supporting [number] of distinct, active users per year who request and use data service provider products.

b. The data service provider shall provide a trained user support staff.

   Levels of service:

   1) one user support staff member per 100 active users;

   2) one user support staff member per 500 active users;

   3) one user support staff member per 1,000 active users.

   (The number of active users is the number of distinct users who request delivery of data and/or information products per year.)

3.10 Implementation Requirements

a. The data service provider shall design and a data and information system capable of meeting its mission requirements. The design shall address hardware configuration and interfaces and allocation of function to platform. The design shall address software configuration, including COTS, software re-use, and new custom software to be developed, including science software embodying product generation algorithms and/or software facilitating integration of science software provided by outside source(s).

b. The data service provider shall develop a staffing plan that addresses staff required to implement and operate the data service provider over its planned lifetime. The staffing plan shall include a breakdown of positions and skill levels assigned to functions.

c. The data service provider shall develop a facility plan, including planning for space, utilities, furnishings, etc., required to support its staff, data and information system, data storage, etc., and the environmental conditioning to be provided.

d. The data service provider shall accomplish the implementation of its data and information system, including purchase and installation of hardware, purchase or licensing and installation and configuration of COTS software, modification, installation and configuration of re-use software, development of new custom software, and integration of all components into a tested system capable of meeting the data service provider's mission requirements.

e. The data service provider shall provide the staff needed to accomplish all needed in-house development and test activities.

3.11 Sustaining Engineering Requirements

a. The data service provider shall maintain and, as needed, enhance custom software it develops to meet its mission needs, and reused software it customizes and integrates, a total of [number] SLOC.

Levels of Service:

1) no or very infrequent interruptions of data service provider operations;

2) occasional interruptions in data service provider operations;

3) as needed, with interruptions in data service provider operations a secondary concern.

References

1. "NewDISS: A 6-to-10-year Approach to Data Systems and Services for NASA's Earth Science Enterprise - Draft Version 1.0", October 2000.

2. "NewDISS Level 0 Requirements", September 2001, Vanessa Griffin ESDIS/SOO and SEEDS Formulation Team.

3. "ESDIS Project Level 2 Requirements: Volume 5: EOSDIS Version 0, Revision B", March 2000, GSFC.

4. "ESDIS Data Center Best Practices and Benchmark Report", September 2001, SGT Inc.

5. "Ensuring the Climate Record from the NPP and NPOESS Meteorological Satellites", NRC Committee on Earth Studies, September 2000.

6. "Global Change Science Requirements for Long-Term Archiving", NOAA-NASA and USGCRP Program Office, March 1999.

Others TBD.